BR Architecture
E-channel/E-path

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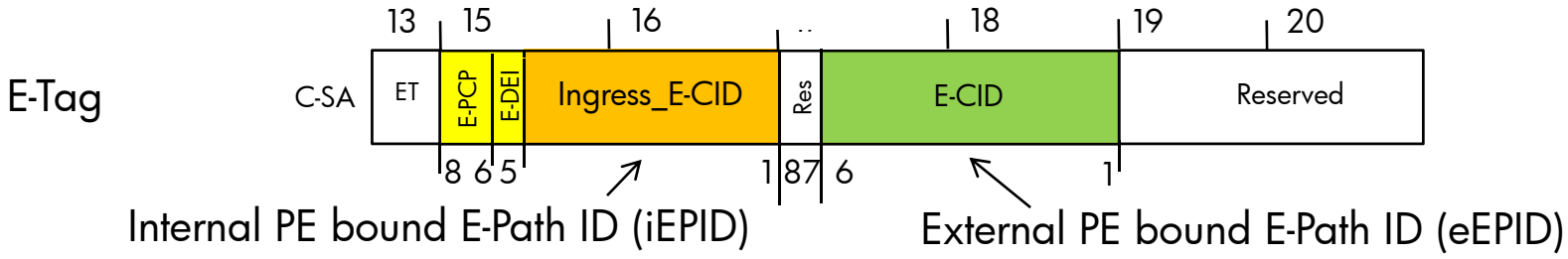
E-Channels and E-Paths are foundation architecture concepts

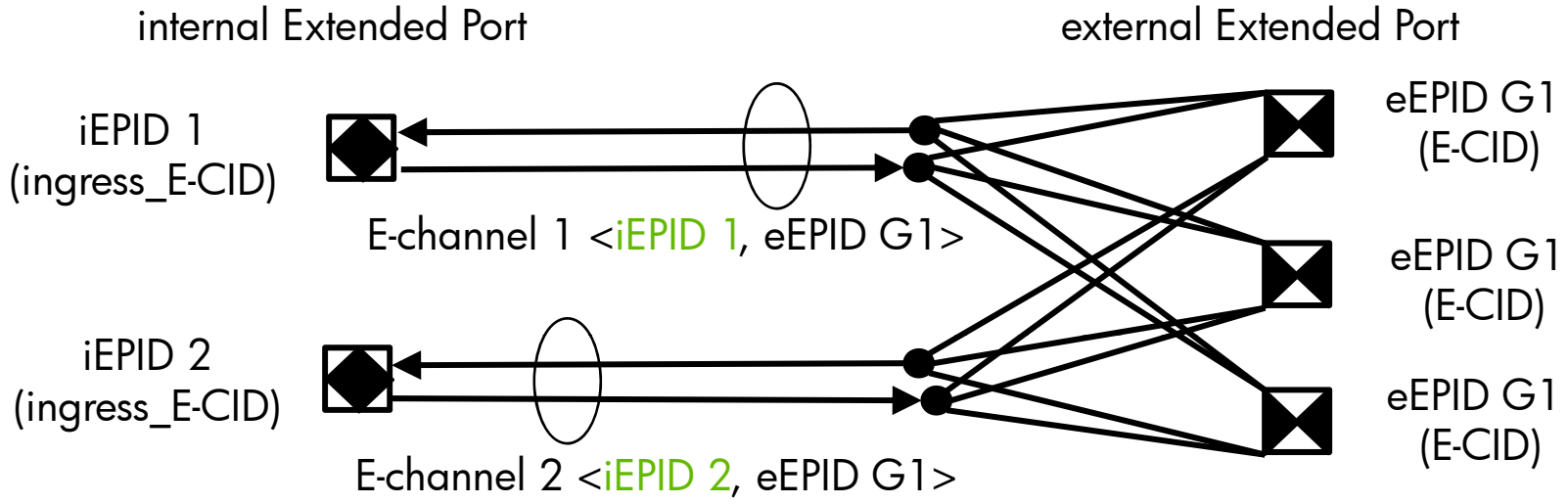
- E-path: A configured unidirectional connectivity path between an internal Extended Port and one or more external Extended Ports. E-paths initiating from the internal Port Extender can be point-to-point or point-to-multipoint. E-path that terminate at the internal Port Extender can be point-to-point or multipoint-to- point.
- E-channel: An instance of the MAC service supported by a set of two E-paths forming a bidirectional service. E-channels can be point-point or point-muli-point.
- An E-channel is a pair E-Paths
  - A pt-pt E-channel is composed of two pt-pt E-Paths, one for each direction
  - A pt-mpt E-channel is composed of one pt-mpt E-Path and one mpt-pt E-Path
- We can also define an E-channel in terms of asymmetric VLANs
  - Asymmetric VLANs described in 802.1Q subclause F.1.3
  - An E-channel is an of asymmetric VLANs, one asymmetric E-Path from the internal EP to external EP(s) and one from the external EP(s) to internal EP

Asymmetric VLANs and E-channels



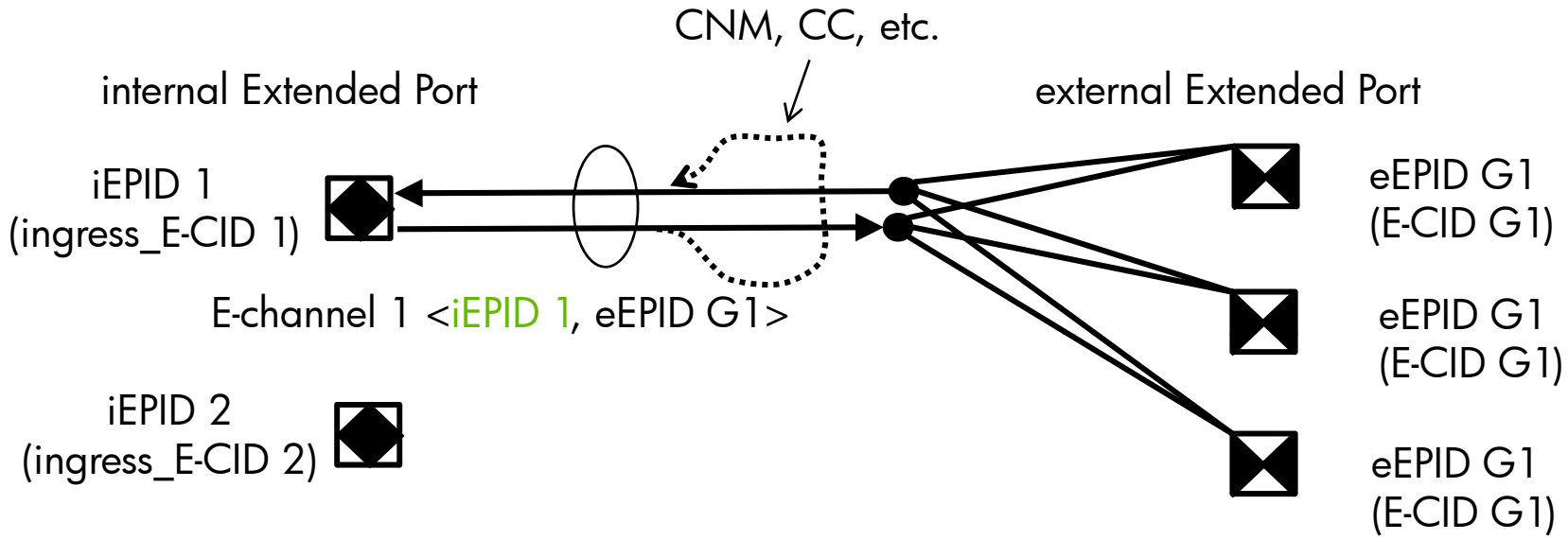
- An asymmetric VLAN is identified by 2 VIDs
  - One VID identifies a directed path from A to B
  - Another VID identifies a directed path from B to A
- An E-channel is an asymmetric VLAN needing an ordered pair of "VIDs" to represent the two E-Paths. Each E-Path also needs an ordered pair to represent it's VID.
  - A "VID1" (<ingress_E-CID, E-CID>) identifying the E-Path from internal EP to external EP
  - A "VID2" (<E-CID, ingess_E-CID>) identifying the E-Path from external EP to internal EP
  - Since the pairs of VID1 and VID2 are always reverse order we can represent the E-channel with the pair <E-CID, ingress_E-CID> = E-CID
  - The current use of ingress_E-CID (iEPID) and E-CID is particularly confusing since these actually identifies the internal EP and external EPs.
  - Consider two pt-mpt E-channels each starting at different internal EPs. Here the E-CID identifies the destination EP group, however does not uniquely identify the E-channel.
  - Consider reverse forwarding in a pt-mpt E-channel. The ingress_E-CID identifies where the frame will return when reversed.
  - Better names for the Ingress_E-CID and E-CID are iEPID and eEPID respectively.

Unique E-channel identification



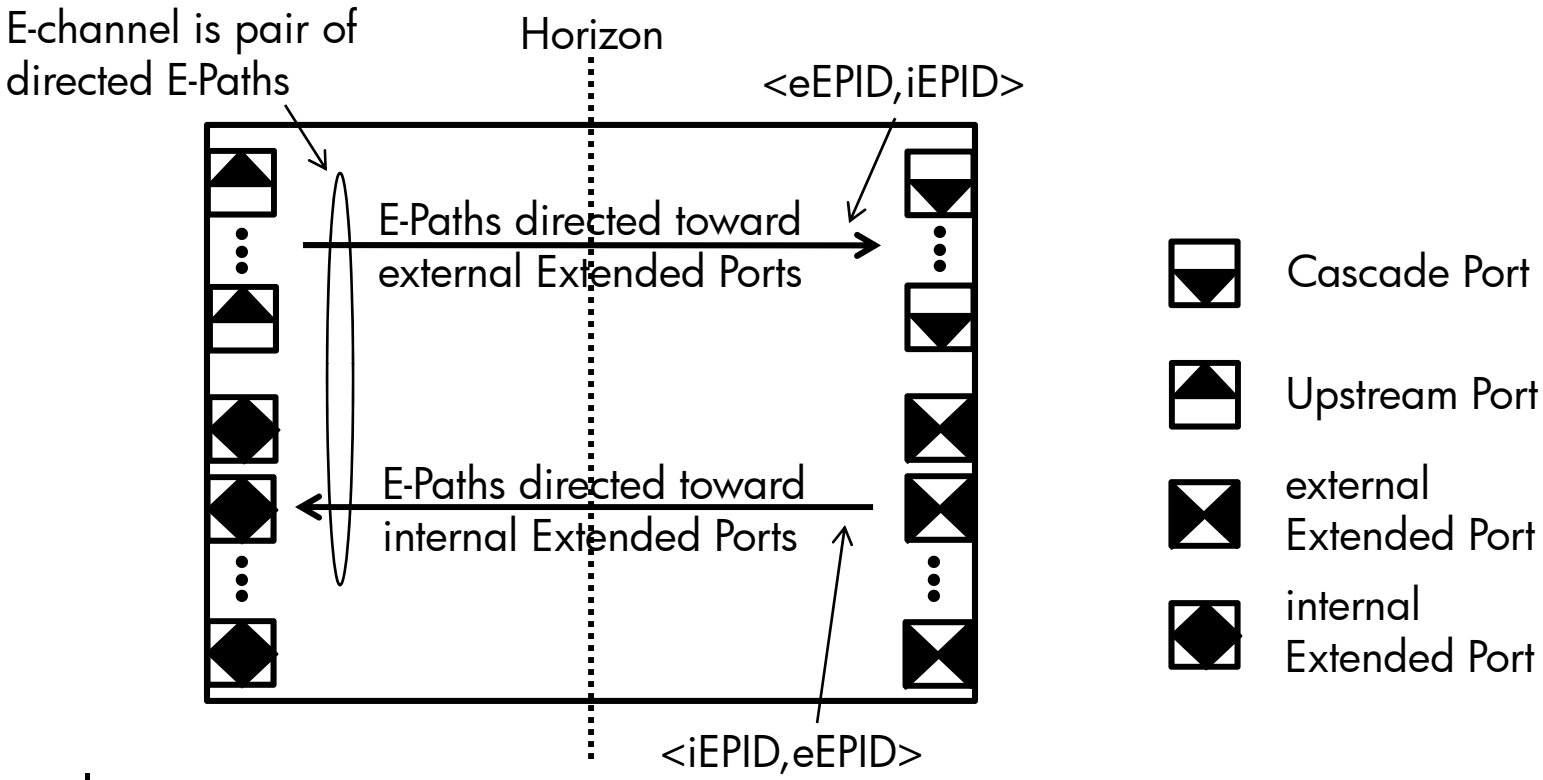
- Here we have two pt-mpt E-channels each with a different internal Extended Port, however addressing the same group of external Extended Ports.
- The eEPID is insufficient to uniquely identify the E-channel
- The two E-channels are differentiated by their iEPIDs
- The identifier for the E-Paths of E-channel 1 are <iEPID 1, eEPID G1> and <eEPID G1, iEPID 1>

Forwarding path reversal



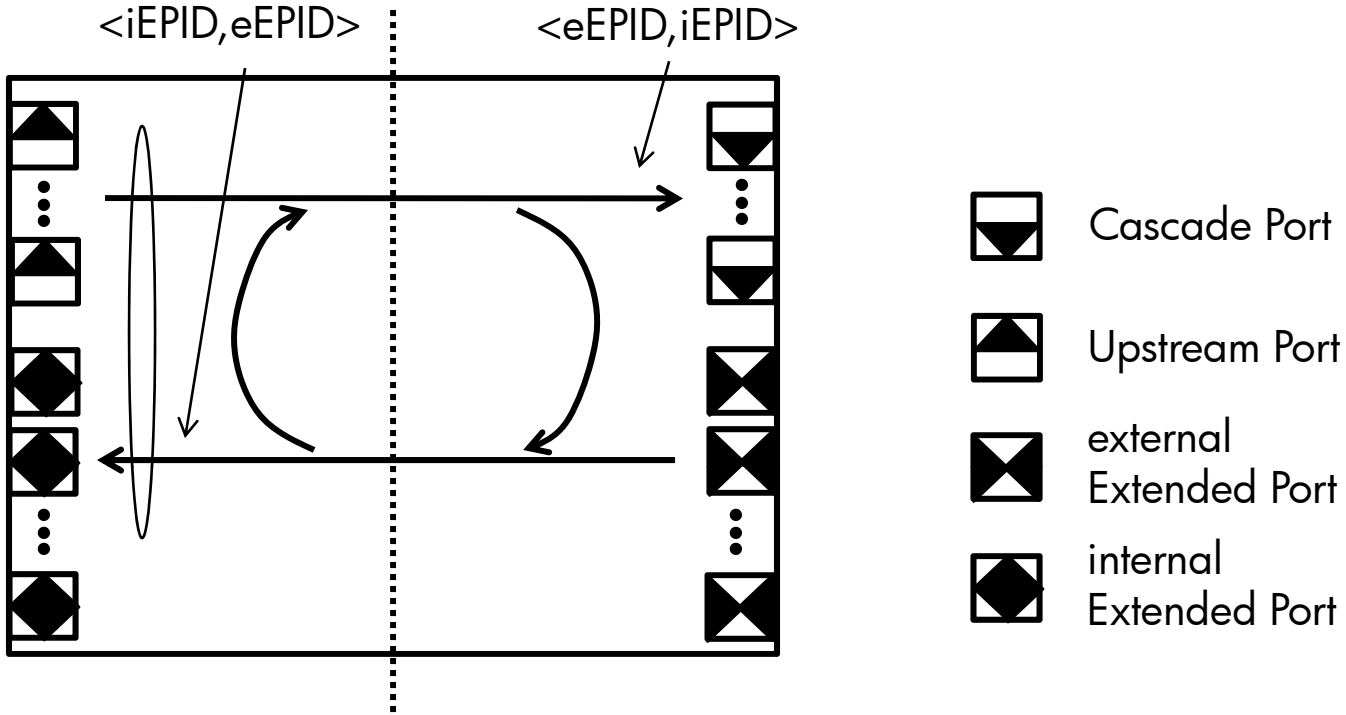
- Here a control or management message uses reverse forwarding to send a message back to the internal Extended Port
- The eEPID is inadequate to select the correct internal Extended Port to return the frame
- To enable reverse forwarding the iEPID must be used to select the correct E-path to the internal Extended Port

Port Extender Operation – Split Horizon



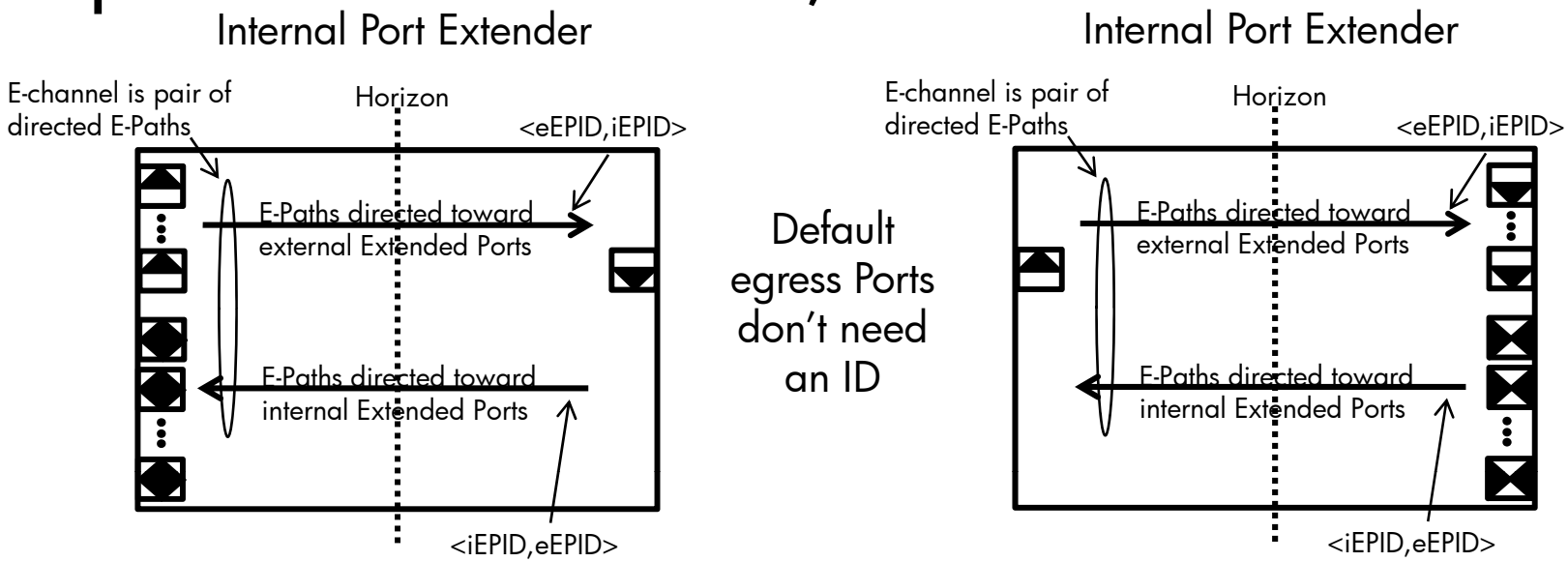
- Filter rules:
  - Frames entering from Upstream Ports and internal Extended Ports must exit on Cascade Ports and external Extended Ports
  - Frames entering from Cascade Ports and external Extended Ports must exit on Upstream Ports and internal Extended Ports

PE Operation – E-TAG Frame Forwarding



- E-channel forwarding is on a pair of co-routed E-Paths identified by the E-TAG
  - Ingress port determines the forwarding direction and therefore the E-Path
  - Internal EP bound E-Paths are forwarded toward the iEPID (from E-TAG)
  - External EP bound E-Paths are forwarded toward the eEPID (from E-TAG)
  - Allows reversible paths required for management (i.e. CFM) and control (i.e. CN)
  - If the iEPID is unregistered for an Internal EP bound frame the frame is forward to a default Upstream Port

Pt-pt E-channel tricks, NOT GOOD



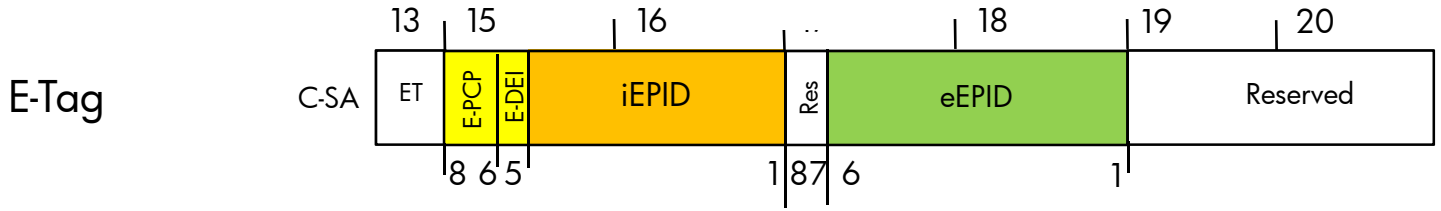
- For the special case where only one "default" Port exists on one side of the horizon divider we can overlap the external Extended Port bound ID and internal Extended Port bound ID spaces
- Therefore for a pt-pt E-channel we could choose the iEPID = eEPID. These don't conflict in this special case since the filtering table always has one or the other.
- Therefore for a pt-pt E-channel we have a special case where iEPID = eEPID = VID of E-channel and of E-paths
- Special case does not work for pt-mpt E-channels since the group eEPID can't identify the source
- The architecture should avoid this trick since it is limiting, however the system conformance can allow it to simplify early implementations

PEISS for split horizon

PEM_UNITDATA.indication (
destination_address,
source_address,
mac_service_data_unit,
priority,
drop_eligible,
forwarding_identifier,
frame_check_sequence,
service_access_point_identifier,
connection_identifier,
iEPID,
eEPID)

- Simple changes to the PEISS support split horizon
- Frames received at an external Extended Port or at a Cascade Port place an iEPID in the forwarding_identifier
  - For external Extended Ports the iEPID comes from the PCID (or pEPID)
- Frames received at an internal Extended Port or at an Upstream Port place an eEPID in the forwarding_identifier
  - For internal Extended Ports the eEPID comes from the pEPID or a port map lookup
- Relay uses forwarding_identifier while the ports use iEPID and eEPID

Summarizing Conclusions



- An E-channel is an asymmetric VLAN identified by E-CID = <iEPID, eEPID>
- An E-TAG carries an E-channel identifier as a 2-tuple of iEPID and eEPID
- Each E-channel is composed of two E-Paths
  - E-Paths may be pt-pt, pt-mpt or mpt-pt
  - Each E-Path identifier is an ordered pair <iEPID, eEPID> or <eEPID, iEPID>
  - E-Paths toward a internal Extended Port (<iEPID,eEPID>) are either pt-pt or mpt-pt
  - E-Paths toward external Extended Ports (<eEPID,iEPID>) are either pt-pt, pt-mpt
- Each iEPID identifies one internal Extended Port
- Each eEPID identifies one or more external Extended Ports
- Port Extender ports implement split horizon using the PEISS
- The Port Extender relay uses either the iEPID or the eEPID depending on the direction of travel to forward the frame